

Six-month mortality risks in long-term care residents with chronic ulcers

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ABSTRACT

Chronic ulcers are a common problem in long-term care. Residents with ongoing ulcers are often frail and at risk for mortality. This study evaluated the relationship between wound characteristics and other health predictors with 6-month mortality in nursing home residents. The subjects included were nursing home residents seen by the wound consult service from 1998 to 2007 with an ongoing chronic ulcer. This was a retrospective cohort study. Data were manually and electronically abstracted for each resident. Six-month mortality was collected as the primary outcome. Statistical comparisons were made using logistic regression with a final multivariate model. Four hundred and forty residents were seen with 411 records reviewed. Ulcer area was not associated with mortality; however, chronic ulcer number was associated with 6-month mortality with an odds ratio of 1.32 (95% CI 1.07–1.63). Other significant risk factors included heart failure, dementia, cancer, depression and blindness with all factors having an odds ratio greater than 1.75. Higher haemoglobin and venous insufficiency were protective of 6-month mortality. Ulcer number is an important predictor for 6-month mortality. The presence of multiple ulcers and comorbid health concerns may influence discussion of prognosis for healing and for potential end of life discussions.

Key words: Chronic ulcers • Elderly • Mortality • Nursing home • Pressure ulcers

INTRODUCTION

Health care providers face many challenges in dealing with chronic ulcers in long-term care (LTC) with one of the biggest challenges being high mortality. Chronic ulcers occur commonly in LTC residents. The prevalence of LTC residents developing pressure ulcers ranges from 11% to 15% (1–3), and the prevalence of venous leg ulcers is estimated at 2.5% (4). Chronic ulcers present a costly problem for the health care system with estimates from as high as 1.35 billion dollars for pressure ulcer care in the USA (1) to

1.5–2 billion pounds in the UK (5). Community advocates and federal regulatory bodies (Centre for Medicare Services, CMS) measure the numbers of pressure ulcers in a facility and use this information as a quality measure of the care (6). This information is reported on the CMS website for public use and scrutiny. The lack of adequate treatment or care of a pressure ulcer can result in a citation from the state survey process (7). When residents develop chronic ulcers, they can suffer adverse outcomes such as infection and sepsis, amputation, hospital admission and mortality. Although several studies have addressed preventive strategies for risk of ulcer development, the risk factors that predict adverse outcomes in LTC in existing chronic ulcers need further elucidation.

LTC providers are concerned about the prognosis of residents with chronic ulcers. The prognosis influences the aggressiveness of medical treatment and also shapes expectations of the resident and the family. Residents with chronic

Key Points

- multiple ulcers place nursing home residents at risk for mortality
- health care providers face many challenges in dealing with chronic ulcers in long-term care (LTC) with one of the biggest challenges being high mortality
- although several studies have addressed preventive strategies for risk of ulcer development, the risk factors that predict adverse outcomes in LTC in existing chronic ulcers need further elucidation

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Key Points

- despite the relationship between the presence of a pressure ulcer and the increased mortality, it remains unclear which skin characteristics place the resident at the most risk for mortality
- this study will identify which wound characteristics influence mortality in residents in LTC
- as a secondary outcome, this study will evaluate the relationship between laboratory values and 6-month mortality in LTC residents with chronic ulcers
- this was a retrospective cohort of adult patients with a diagnosis of pressure ulcer or other chronic ulcers (ischaemic, venous, neuropathic and mixed) seen in LTC facilities affiliated with Mayo Clinic
- the primary predictor variables collected involved five major categories including wound characteristics, laboratory data, demographic information, previous vascular diseases and other comorbid health conditions

ulcers are certainly at risk for mortality. Older adults (>75 years) living in the community with a pressure ulcer had a mortality rate of 29% in 12 months with a relative risk of 1.92 (95% CI 1.52–2.43) (8). Residents in a LTC hospital had similar relative risks of mortality (9). US statistics for 1990–2001 show that the age-adjusted mortality rate of individuals with pressure ulcers was 3.79/100 000 (10). Despite the relationship between the presence of a pressure ulcer and the increased mortality, it remains unclear which skin characteristics place the resident at the most risk for mortality. The identification of potential risk factors for 6-month mortality in LTC residents with a chronic wound would be extremely useful for health care providers and is currently unknown. This study will identify which wound characteristics influence mortality in residents in LTC. As a secondary outcome, this study will evaluate the relationship between laboratory values and 6-month mortality in LTC residents with chronic ulcers.

METHODS

This was a retrospective cohort of adult patients with a diagnosis of pressure ulcer or other chronic ulcers (ischaemic, venous, neuropathic and mixed) seen in LTC facilities affiliated with Mayo Clinic. The subjects were assessed for multiple potential risk factors for adverse outcomes, which included demographic factors, wound characteristics and comorbid health status. The Mayo Clinic Institutional Review Board reviewed the protocol and approved it. All aspects of the research on this project were made in accordance with the principles of the Declaration of Helsinki. The investigators also adhered to Minnesota state law with regard to medical record use and privacy. The data were abstracted manually with blinded, trained personnel with assistance by administrative databases.

Study subjects

Inclusion criteria

The inclusion criteria consisted of adults with an incident diagnosis of a pressure, ischaemic, venous, neuropathic or mixed ulcer between 1 November 1998 and 1 January 2007. All subjects resided at nursing homes affiliated with Mayo Clinic (eight facilities); however, all patients were followed by the same wound care consultation team. The date of diagnosis of the ulcer was the initial documented wound care visit in the LTC facility. Residents with single or multiple ulcers

were included within the analysis. An individual with a chronic wound had a wound that required wound consultation, and the wound was categorised as a pressure ulcer, ischaemic ulcer, venous ulcer, neuropathic ulcer and mixed or other. The operational criteria for a pressure ulcer included new ulceration on an area of pressure over a bony prominence. Individuals with a pressure ulcer and aetiologies of a mixed ulcer (such as a pressure ulcer of the heel with an ischaemic component) were analysed. Ischaemic ulcers were defined as an ulcer that occurred in an area of arterial insufficiency. The diagnosis of an ischaemic ulcer was made clinically by the provider at the time of the visit (with or without subsequent arterial testing) (11). Venous ulcers were defined as ulcers that developed in an area of venous insufficiency or oedema with the diagnosis being made clinically (12). Neuropathic ulcers were classified as ulcers in an area of peripheral neuropathy and pressure (often involving the metatarsal heads) with supplemental diagnostic testing as required by the provider (13). The other classification of ulcers included ulcers that were mixed or traumatic.

Exclusion criteria

Patients enrolled in hospice were not included. Patients who do not give consent (in accordance with Minnesota state law) were also excluded from the analysis.

Data collection

Data were obtained from patients seen by the nursing home consultation service in the Mayo Clinic system from 1 November 1998 to 1 January 2007. Information was abstracted directly from the wound registry and medical records and from administrative data within the Mayo Clinic Rochester health records system. The Mayo Clinic maintains all electronic medical record information within one system including documentation of nursing home care. All subjects enrolled in the study were primary Mayo Clinic patients and were followed prospectively by primary providers within the Mayo Clinic system. All comorbid health conditions as predictors were determined by previous clinical diagnosis prior to the initial development of ulceration.

Predictor variables and primary outcome

The primary predictor variables collected involved five major categories including wound

characteristics, laboratory data, demographic information, previous vascular diseases and other comorbid health conditions. The first three categories were obtained on the initial consultation with the resident. Wound characteristics and laboratory data were the primary areas of interest and investigation. Laboratory data were obtained within the previous 6 months of initial evaluation. Vascular disease and other comorbid health conditions were also noted as predictors for 6-month mortality. The predictors are listed below.

- a) Wound characteristics: calculated wound area (cm²) and wound number.
- b) Laboratory values: haemoglobin (g/dl), white blood cell count ($\times 10^9/l$) and creatinine (mg/dl).
- c) Demographic factors: age (years), gender, calculated body mass index (BMI) (kg/m²), nursing home status and ulcer type.
- d) Vascular disease: coronary artery disease, congestive heart failure, peripheral vascular disease, venous insufficiency, diabetes mellitus, renal insufficiency and previous stroke.
- e) Other comorbid health conditions: cancer (non dermal), degenerative arthritis, rheumatoid arthritis, dementia, depression, peripheral neuropathy, previous falls and blindness.

The primary outcome variable was 6-month mortality from the initial diagnostic evaluation from the nursing home consultative wound service. This information was checked both manually and by electronic abstraction. When there were discrepancies, the information was verified by the investigators to ensure an adequate assessment of mortality.

Data analysis

All information was entered into a Microsoft Excel (version 2003; Microsoft, Redmond, WA) spreadsheet for data entry, data retrieval and analysis. The investigators analysed the final information using SAS/STAT 9.03 (SAS Institute Inc., Cary, NC). The analysis was undertaken in three parts. The initial analysis comparing 6-month mortality involved either two-sample *t*-test for continuous variables or Pearson chi-squared test for categorical variables. Univariate logistic regression analysis with and without age and gender adjustment was

utilised to determine odds ratios. The findings from the univariate regression were used to determine whether the variables were statistically significant ($P < 0.05$). All predictor variables with a P value < 0.10 on univariate analysis were evaluated with multivariable analysis. Variables that were not significant but were clinically important were included in the analysis. Multivariate logistic regression was used to derive a final model using a stepwise elimination approach.

RESULTS

Four hundred and forty residents had been seen by the wound consultation service for a non healing ulcer from 1998 to 2007. Consent was obtained from 411 residents for records review. Overall, 111 subjects died in 6 months (27%), with the overall average age of 77.1 ± 12 years. The residents lived at one of eight nursing homes, with 136 residents (33%) from one nursing home. The association between nursing home residency and 6-month mortality did not show a statistically significant relationship with a P value of 0.62. Forty-eight percent of the residents were male with the average BMI of 30.2. The wound types varied; however, the following percentages of ulcer type were noted as follows: pressure ulcers 52.4%, ischaemic ulcers 28%, venous ulcers 5.8%, neuropathic ulcers 3.3% and mixed ulcers 10.4%. There was no association between ulcer type and 6-month mortality with a chi-square value of 6.99 and a P value of 0.14. Forty-eight percent of the residents had more than one chronic ulcer with the median size of the largest ulcer in each resident of 4.25 cm². The median number of ulcers was 1 with a 25–75% quartile range from 0–2. Table 1 shows the average mean values (\pm standard deviation) or the absolute numbers (with percentages) for subjects who died in 6 months and those who survived in 6 months. The P value is noted for significance in a univariate unadjusted fashion as well as the odds ratio with 95% confidence intervals. Thirteen factors had a P value less than 0.10 and were included in the final model. Of the wound characteristics, ulcer number had an odds ratio of 1.23 (95% CI 1.01–1.48). In the laboratory and demographic categories, haemoglobin, age and BMI were significant. The highest odds ratios for death included blindness with an odds ratio of 2.26 (95% CI 1.01–6.48) and dementia with an odds ratio of 2.37 (95% CI 1.50–3.75). Vascular

Key Points

- this study found that 27% of residents with a chronic ulcer seen by a wound care consultative service died within 6 months of initial care

Table 1 Univariate, unadjusted odds ratios and odds ratios adjusted for age and gender

Predictor	Subjects living (<i>n</i> = 300)	Subjects died (<i>n</i> = 111)	<i>P</i> value	Odds ratio (95% CI)
Wound characteristics				
Ulcer number	1.78 ± 1.21	2.11 ± 1.26	0.034*	1.23 (1.01–1.48)
Ulcer area (cm ²)	12.4 ± 27.0	14.4 ± 21.0	0.52	1.00 (0.99–1.01)
Laboratory values				
Haemoglobin (g/dl)	11.42 ± 1.51	11.1 ± 1.39	0.09*	0.86 (0.73–1.02)
WBC (10 ⁹ /l)	8.87 ± 5.71	9.55 ± 3.47	0.28	1.02 (0.98–1.07)
Creatinine (mg/dl)	2.49 ± 9.55	1.9 ± 1.40	0.55	0.99 (0.93–1.04)
Demographics				
Age (years)	76.15 ± 12.3	80.59 ± 10.72	<0.001*	1.03 (1.01–1.06)
BMI (kg/m ²)	30.98 ± 16.38	27.43 ± 6.26	0.042*	0.96 (0.93–0.99)
Male	138 (46%)	58 (52%)	0.26	1.29 (0.83–1.99)
Vascular illnesses				
Coronary disease	139 (46%)	54 (49%)	0.68	1.10 (0.71–1.70)
Heart failure	101 (34%)	58 (52%)	<0.001*	2.16 (1.39–3.38)
Stroke	87 (29%)	35 (32%)	0.62	1.13 (0.70–1.81)
Peripheral vascular disease	78 (26%)	39 (35%)	0.07*	1.54 (0.97–2.46)
Venous insufficiency	41 (14%)	4 (4%)	0.004*	0.24 (0.08–0.67)
Diabetes	139 (46%)	51 (55%)	0.94	0.96 (0.64–1.52)
Comorbid illness				
Dementia	73 (24%)	48 (43%)	<0.001*	2.37 (1.50–3.75)
Depression	108 (36%)	61 (55%)	<0.001*	2.17 (1.39–3.37)
Cancer	87 (29%)	35 (32%)	<0.001*	2.16 (1.38–3.38)
Renal insufficiency	76 (25%)	48 (43%)	<0.001*	2.25 (1.42–3.55)
Blindness	10 (3%)	9 (8%)	0.041*	2.26 (1.01–6.48)
Rheumatoid arthritis	25 (8%)	12 (11%)	0.44	1.33 (0.65–2.76)
Degenerative arthritis	133 (44%)	50 (45%)	0.9	1.03 (0.66–1.60)
Peripheral neuropathy	92 (31%)	29 (26%)	0.37	0.80 (0.49–1.30)
Previous fall	64 (21%)	40 (36%)	0.002*	2.08 (1.29–3.34)

BMI, body mass index; WBC, white blood cell.

*Predictors significant for evaluation in the final multivariable model.

predictive risks of heart failure, peripheral vascular disease and venous insufficiency as well as the remaining comorbid health conditions of depression, cancer, renal insufficiency and previous fall were significant.

After initial univariate analysis, the 13 predictors were placed in a final model to determine which predictor factors were associated with mortality after adjustment with other risk factors. Using stepwise analysis, the results of the full model are noted in Table 2. Eight factors remained significant in the final model after adjustment. Of the wound characteristics, laboratory values and demographics, ulcer number remained significant with an odds ratio of 1.32 (95% CI 1.07–1.63) as well as haemoglobin with an odds ratio of 0.75 (95% CI 0.60–0.93). Vascular risks of congestive heart failure and venous insufficiency were significant with residents possessing venous insufficiency and having less risk of mortality. Comorbid health condi-

tions associated with 6-month mortality included dementia, depression and cancer with odds ratio more than 2. Blindness also was significantly associated with mortality with an odds ratio of 7.51 (95% CI 1.96–28.76). The remaining five predictors were not associated with mortality in the final model; although, BMI trended towards significance with a *P* value of 0.07.

DISCUSSION

It is well recognised that LTC residents are at high risk for developing chronic ulcers, which increases their risk of death and disability. The development of chronic non healing ulcers in residents in LTC often portends worsening clinical or functional status in many of these residents (14). This study found that 27% of residents with a chronic ulcer seen by a wound care consultative service died within 6 months of initial care. This finding corresponds to the 36.8% of 6-month mortality found in patients

Table 2 Final multivariable model

Risk factor	Odds ratio	95% CI	P value
Wound characteristics			
Ulcer number	1.32	1.07–1.63	0.010*
Laboratory values			
Haemoglobin	0.75	0.60–0.93	0.010*
Demographics			
Age	1.02	0.99–1.05	0.299
BMI	0.96	0.92–1.00	0.072
Vascular illnesses			
Congestive heart failure	2.05	1.10–3.82	0.023*
Peripheral vascular disease	1.55	0.82–2.91	0.176
Venous insufficiency	0.18	0.05–0.61	0.006*
Comorbid illnesses			
Dementia	2.30	1.09–4.85	0.028*
Depression	2.55	1.36–4.81	0.004*
Cancer	2.57	1.37–4.82	0.003*
Renal insufficiency	1.82	0.97–3.39	0.062
Blindness	7.51	1.96–28.76	0.003*
Previous fall	0.82	0.40–1.69	0.590

BMI, body mass index.

*Statistically significant factors for 6-month mortality.

with advanced dementia cohort in LTC (15). In residents with full-thickness pressure ulcers in a long-term Veterans Administration (VA) facility, 180-day mortality was 68.9% (16). In contrast to the nursing home population, healthy, younger patients with diabetic foot ulcers had a 6-month mortality of 6.2% (17). In our study, the residents had more than one chronic ulcer requiring treatment 48% of the time. Ulcer number had an unadjusted odds ratio of 1.23 (95% CI 1.01–1.48) with an average of two ulcers in those residents who died within 6 months. After adjustment for other comorbid health conditions, the odds ratio still remained at 1.32 (95% CI 1.07–1.63). Ulcer area did not impact death and was not significantly different between those residents who lived and those who died. In a study looking at diabetic foot ulcers, ulcer size did not predict mortality (18). Clinically, residents with multiple ulcers are at higher risk of death and likely indicate a severe clinical status (end-stage atherosclerosis obliterans (ASO) with lower extremity ulcers, extreme debility with multiple pressure ulcers, etc.).

In the risk categories of laboratory values and demographics, the predictors of haemoglobin, age and BMI were significantly associated with 6-month mortality on univariable evaluation. Higher haemoglobin levels had a protective effect against mortality on both unadjusted and

adjusted analysis. Higher haemoglobin levels appear to improve survival in nursing home residents (19,20). Our findings with haemoglobin in patients with chronic ulcers are consistent with these studies. Both age and BMI were significantly associated with mortality in the unadjusted analysis but were not associated with mortality after adjustment in the final model. Other studies using National Health and Nutrition Examination Survey (NHANES) data have shown a relationship between underweight and obese adults and increased mortality (21). Life expectancy in the nursing home decreases with increasing age in other studies (22). In our study, BMI trended towards a significant value on adjusted analysis; thus, it is possible that a larger sample would have confirmed this relationship. The lack of a relationship between age and mortality after adjustment in patients with chronic wounds may reflect a smaller contribution of age to mortality in this population.

Vascular diseases with attention to congestive heart failure are associated with 6-month mortality. Congestive heart failure had an odds ratio of 2.05 (95% CI 1.10–3.82), which is consistent with heart failure as risk for mortality in LTC (23). Venous disease appears to be a protective factor for mortality and may represent a different subset of LTC residents with chronic ulcers. Coronary disease, stroke and diabetes are all well-known factors for mortality, but these factors were not significant for 6-month mortality in this study. Studies of patients with chronic wounds and mortality in LTC do not readily exist. These findings might represent survivorship bias in that the residents with a chronic ulcer and vascular disease might represent a different population of vascular patients compared with those patients who did not survive to the nursing home.

Other comorbid mortality predictors are clearly seen in this study, which confirms other observations. Cancer, depression and dementia were associated with 6-month mortality after adjustment with odds ratios more than 2. Cancer is a well-known risk factor for death and is a factor in many predictive models for mortality including the Simplified Acute Physiology Score (SAPS 2) and Acute Physiology and Chronic Health Evaluation (APACHE 3) scoring systems (24,25). Depression affecting the frail elderly in the community has been associated with higher mortality (26,27). Depression in

Key Points

- higher haemoglobin levels appear to improve survival in nursing home residents
- the lack of a relationship between age and mortality after adjustment in patients with chronic wounds may reflect a smaller contribution of age to mortality in this population
- coronary disease, stroke and diabetes are all well-known factors for mortality, but these factors were not significant for 6-month mortality in this study

Key Points

- this study provides important insight into the potential risk factors for death in LTC residents with chronic ulcers
- one limitation of this study involves the retrospective cohort design and the potential for missing information
- other wound characteristics could potentially play a role in mortality and were not uniformly recorded and not used in this analysis
- it appears that multiple chronic ulcers increase the risk of 6-month mortality, while wound size did not impact mortality
- the primary consideration for health care providers in LTC is a realistic expectation of healing with a full understanding that mortality in the short term is very common
- in those patients with multiple ulcers and significant comorbid medical conditions, one might consider palliative care and hospice
- this course of care might provide better quality of life for the resident and realistic expectations for future prognosis

LTC has also been associated with higher mortality (28). Dementia is also associated with higher mortality in LTC residents as well (29). Blindness had a high risk of mortality in this population with an odds ratio of 7.51 (95% CI 1.96–28.76); however, only 19 residents had blindness. The other risk factors of rheumatoid arthritis, degenerative arthritis and peripheral neuropathy did not affect mortality. Previous falls were associated with mortality on unadjusted analysis but were not after adjustment. Falls clearly place the LTC resident at risk for mortality (30).

This study provides important insight into the potential risk factors for death in LTC residents with chronic ulcers. One limitation of this study involves the retrospective cohort design and the potential for missing information. In particular, other wound characteristics could potentially play a role in mortality and were not uniformly recorded and not used in this analysis. The information from the medical record was fairly complete; however, some information was not recorded that could lead to some bias in the results. The outcome of 6-month mortality was cross-referenced by two different methods (manual abstraction and electronic abstraction) and appeared complete. However, some predictor factors were often not recorded or not applicable. The population seen by the wound consultative service could be sicker than the general resident population in the LTC facility and may reflect a referral bias. However, providers often have discussions of prognosis with patients having wounds when the ulcer is severe or the ulcer is not healing, which represents the population seen by the consultative service. There were eight different facilities, and there could be some heterogeneity of care; however, the wound consult service provided the wound care plans for all subjects. Electronic abstraction of diagnosis from previous medical records could potentially miss an underlying diagnosis. In previous studies with electronic abstraction of Mayo records using electronic and recorded diagnosis, the percent accuracy exceeded 98% (31). Lastly, survivorship bias might influence the population in LTC with respect to traditional risk factors for mortality.

This study provides important information about the importance of ulcer number and the risk of mortality. It appears that multiple chronic ulcers increase the risk of 6-month mortality, while wound size did not impact mortality.

Traditional risk factors significantly influencing 6-month mortality included haemoglobin, congestive heart failure, dementia, depression and cancer. Blindness was an uncommon occurrence, and it also influenced mortality. The primary consideration for health care providers in LTC is a realistic expectation of healing with a full understanding that mortality in the short term is very common. In those patients with multiple ulcers and significant comorbid medical conditions, one might consider palliative care and hospice. This course of care might provide better quality of life for the resident and realistic expectations for future prognosis (32).

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